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# Introducing Adaptive Machine Learning Technique for Solving Short-Term Hydrothermal Scheduling with prohibited discharge zones

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**Statement of the problem:** The short-term hydrothermal scheduling (STHTS) problem has paramount importance in an interconnected power system. Owing to an operational research problem, it has been a basic concern of power companies to minimize fuel costs. To solve STHTS, a cascaded topology of four hydel generators with one equivalent thermal generator is considered. The problem is complex and non-linear and has equality and inequality constraints, including water discharge rate constraint, power generation constraint of hydel and thermal power generators, power balance constraint, reservoir storage constraint, initial and end volume constraint of water reservoirs, and hydraulic continuity constraint. The time delays in the transport of water from one reservoir to the other are also considered.

**Methodology & theoretical orientation:** The research work under consideration is the extension of work done in [1-6]. It is intended to develop and embed an adaptive machine learning model with any meta-heuristic algorithm for the solution of the STHTS problem with prohibited discharge zones (PDZ). A meta-heuristic technique is used to solve the STHTS without PDZ. The “sub-optimal” solution just obtained is fed as an input to a machine learning (ML) model that outputs an optimal solution with PDZ and VPL effect. Firstly, the model is trained on a data set. Once trained, it can be applied to the solution of any meta-heuristic algorithm without PDZ. The execution time is negligible, as once the model is trained it gives the results within no time. In the past, no such amalgam was made and applied to solve the STHTS problem at hand.

**Findings:** A drastic improvement in the results is observed. The versatility and effectiveness of the proposed approach are tested by applying it to the previous works and comparing the cost of power generation given by this model with those in the literature. A comparison of results and the monetary savings that could be achieved by using this approach instead of using only metaheuristic algorithms for PDZ and VPL are also given. The slipups in the VPL case in the literature are also addressed.

**Conclusion:** The short-term hydrothermal scheduling problem with prohibited discharge zones has been very important in power systems and it has been solved by many metaheuristic techniques in the past. This research has introduced a novel methodology to solve STHTS with PDZ and proves that its results are better than that of merely using metaheuristic techniques. A machine learning model has been made that can be run over the results obtained from any metaheuristic technique. The output of the ML model, i.e., the solution to STHTS with PDZ, is better than those obtained by only applying the metaheuristic technique.

The extraordinary performance obtained by the proposed technique urges research-ers to solve the problem at hand from scratch. In other words, starting from constant dis-charge rates or randomly initialized discharge rates, a model should be made that gives the best results for STHTS without PDZ. Furthermore, the existing model can be extended and can be tested over other larger and more complex hydrothermal systems

## Biography

Saqib Akram received his B.Sc. and M.Sc. degrees in electrical engineering with a specialization in power systems and control systems, respectively, from the University of Engineering and Technology (UET), Lahore, Pakistan. He is working as an Embedded System Engineer at Powersoft19 Pvt. Ltd. His current research interests are in the optimization of algorithms and their robustness, metaheuristic algorithms, big data analysis, power electronics, and high-current test systems.